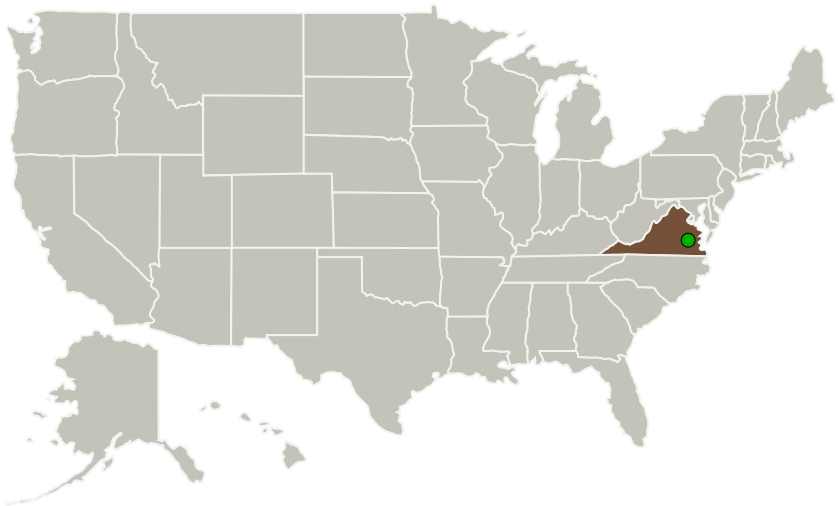
Additive Friction Stir Deposition of Aluminum Alloys and Functionally Graded Structures, Phase II

Completed Technology Project (2014 - 2016)

Project Introduction

State-of-the-art additive manufacturing technologies for metal parts have evolved primarily around powder metallurgy and fusion welding-based processes. These processing methodologies yield parts with inferior mechanical and physical properties as compared to wrought metal of the same composition. Additionally, the production rates for even the fastest processes are relatively low, the part envelopes are limited to a few cubic feet, and often the process must be conducted in an atmospherically controlled chamber. Aeroprobe's additive friction stir (AFS) process is a novel high-speed, large-volume wrought metal additive manufacturing technology that will enable affordable, full-density, near net-shape component manufacturing from a wide range of alloys, including aerospace aluminum alloys, nickel-based super alloys, and metal matrix composites. The ability to rapidly fabricate large-scale, complex wrought and functionally graded aluminum components from three-dimensional models will be an enabling manufacturing advancement in exploration launch vehicle fabrication, for parts such as those on the Orion Crew Module. A scaled representation of the window frame structure proposed for the Orion Crew Module was fabricated from 6061 Al using Aeroprobe's additive friction stir process during the Phase I program. To move AFS up the TRL ladder to full-scale demonstration and deployment, two major technical objectives must be met: (1) develop process/structure/property relationships for AFS deposition of aluminum aerospace alloys, such as 2219, which can be used for process control and material property optimization; and (2) demonstrate net-shape, large-scale aluminum launch vehicle and aerospace components (including a functionally graded structure) with mechanical properties comparable to traditional wrought metals.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Schultz-Creehan Holdings Inc

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

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Organizations Performing Work	Role	Type	Location
Schultz-Creehan Holdings Inc	Lead Organization	Industry Women-Owned Small Business (WOSB)	Blacksburg, Virginia
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations
Virginia

Project Transitions

June 2014: Project Start

June 2016: Closed out

Closeout Summary: Additive Friction Stir Deposition of Aluminum Alloys and F unctionally Graded Structures, Phase II Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/137454)*

Images

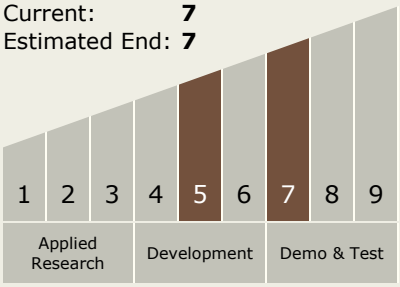
Briefing Chart Image
Additive Friction Stir Deposition of Aluminum Alloys and Functionally Graded Structures, Phase II
(https://techport.nasa.gov/image/134577)

Project Management *(cont.)*

Principal Investigator:
Jianqing Su

Technology Maturity (TRL)

Start: **5**
Current: **7**
Estimated End: **7**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.1 Manufacturing Processes

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System